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5 Claims

1. Particulate material intended for dispersion in a liquid medium to provide a suspension, the particulate material comprising a plurality of particles dispersible in the liquid medium, the particles optionally each comprising an active agent wherein the particles are density-controlled, each particle comprising an effective quantity of a density-reducing agent within the particle to provide the particle with a desired bulk density.

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2. Particulate material according to claim 1 wherein the quantity of density-reducing agent is sufficient to permit the particles to be uniformly and stably dispersed in the liquid medium or is sufficient to provide the particles with a density less than or equal to the density of the liquid medium or is from about 0.8 g/ml to about 1 g/ml.

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3. Particulate material according to claim 1 wherein the density of the particles is such that the particles can maintain a uniform distribution in the liquid medium when standing quiescent at about room temperature for a period of at least 1 month.

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4. Particulate material according to claim 1 wherein the particulate material comprises gel beads.

5. Particulate material according to claim 2 wherein the particulate material comprises gel beads.

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6. Gel beads according to claim 2 wherein the gel beads have a visual property selected from the group consisting of visibility in the intended liquid medium, a transparent colored appearance, a transparent colored appearance and transparency in the intended liquid medium.

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7. Gel beads according to claim 2 wherein the gel beads comprise or constitute a cosmetic or pharmaceutical material intended for topical application to the skin, hair, nails, oral or other bodily cavity of a mammal.

8. Gel beads according to claim 6 wherein the gel beads have a density relative to water of close to 1.0.

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9. Gel beads according to claim 6 wherein the gel beads have an average diameter or other maximum dimension in a range selected from the group consisting of from about 0.1 mm to about 10 mm and from about 0.5 mm to about 3 mm.

10. Gel beads according to claim 6 wherein the gel beads comprise a material selected from the group consisting of agar, synthetic polymers and copolymers, natural polymers, botanically derived gels, vinyl

- 5 polymers, acrylamide polymers, polysaccharides, proteins, and carbopol.
11. Gel beads according to claim 6 wherein the density-reducing agent comprises hollow microspheres having a polymeric shell around the hollow interior.
- 10 12. Gel beads according to claim 6 wherein the density-reducing agent comprises thermally expandable microspheres having a polymeric shell around a hollow interior.
13. Gel beads according to claim 6 wherein the quantity of density-reducing agent is in the range of from about 0.02 weight percent to about 0.1 weight percent of the gel bead.
- 15 14. Gel beads according to claim 13 wherein the density of the density-reducing agent is from about 0.03 g/cc to 0.06 g/cc.
15. Gel beads according to claim 6 wherein the active agent is selected from the group consisting of
- 20 antioxidants, botanically derived polyphenols, procyanidin oligomers, free radical scavengers, topically active enzymes, antibacterials, glucose oxidase, antioxidants, superoxide dismutase, proteolytic enzymes, bromelain, DNA repair enzymes, exfoliative retinoids, retinol, retinol esters, retinol acetate, vitamin A palmitate, purified plant extracts, plant proteins, whitening agents, arbutin, essential fatty acids, linoleic acid, linolenic acid, arachidonic acid, collagen, elastin, keratin, moisturizers, hyaluronic acid, glycosaminoglycans,
- 25 ultraviolet light filters, ultraviolet light absorbents, coated and uncoated organic and inorganic pigments, titanium, zinc, and iron oxides, melanin, sepia ink extract, colorants, dyes and perfumes.
16. Gel beads according to claim 15 wherein the gel beads comprise a restraining polymer dispersed in the gel bead.
- 30 17. Gel beads according to claim 16 wherein the restraining polymer has a molecular weight of at least 50,000 daltons and effective to prevent egress of the restraining polymer from the gel, having retention groups to bind the active agent to the restraining polymer for retention in the gel beads, being present in a proportion effective to deliver an effective amount of the active agent and being selected from the group
- 35 consisting of polyquaternium 11, polyquaternium 24, laurdimonium hydroxyethylcellulose, cocodimonium hydroxyethylcellulose, steardimonium hydroxyethylcellulose, quaternary ammonium substituted water-soluble polysaccharides, alkyl quaternary celluloses and polypeptides having or provided with retention groups to retain the active agent.

5 18. A suspension comprising particulate material dispersed in a liquid medium wherein the particulate material is material according to claim 1.

19. A suspension comprising gel beads dispersed in a liquid medium wherein the gel beads are gel beads according to claim 6.

10 20. A suspension according to claim 19 wherein the liquid medium comprises an aqueous medium, an oil medium, a silicone medium or a lipophilic medium, the liquid medium optionally being transparent.

15 21. A suspension according to claim 20 wherein the liquid medium has a density of about 1.0 g/ml or less than about 1.2 g/ml.

22. A suspension according to claim 20 wherein the refractive indices of the gel beads and the liquid medium are sufficiently different one from the other that the particles are clearly visible in the liquid medium.

20 23. A suspension according to claim 19 wherein the suspension is suitable for application to or ingestion by humans or other mammals.

25 24. A suspension according to claim 19 wherein the suspension comprises a cosmetic, a pharmaceutical or a foodstuff.

25. A suspension according to claim 19 wherein the suspension comprises a cosmetic or a pharmaceutical and is a lotion, a cream or a gel.

30 26. A method of preparing density-controlled beads according to claim 5, the gel beads being formed of bead material that is liquid at elevated temperatures, the method comprising admixing bead material ingredients at an elevated temperature, forming the resultant mixture into droplets or globules; and cooling the droplets or globules to form beads the method comprising including in the bead material ingredients a density-control agent in a quantity sufficient to provide a desired gel bead density

35 27. A method according to claim 26 comprising the elements of:
a) dissolving a water soluble gelling agent, optionally agar, in water heated to a first temperature sufficient to dissolve the gelling agent, in a proportion of gel to water effective to form a gel at a lower temperature than the elevated temperature to form a first mixture;

- 5 b) dispersing a density-control agent in water or oil at room temperature to form a second mixture;
- c) adding the second mixture to the first mixture to form a third mixture and then cooling the third mixture to an intermediate temperature above the gelling point of the first mixture; and
- d) discharging the cooled third mixture through a needle to form drops; and
- 10 e) exposing the drops to a hydrophobic liquid maintained at a temperature below the first mixture's gelling point, whereby the drops are formed into gel beads incorporating the density-reducing agent.

28. A method according to claim 29 wherein the gel beads have an average particle diameter of from about
15 0.1 mm to 10 mm.

29. A method according to claim 27 wherein the first temperature is about 90°C.

30. A method according to claim 27 wherein a water-soluble restraining polymer is included in the gel
20 beads.

31. A method according to claim 30 wherein an active agent is added to the second mixture before adding the second mixture to the third mixture.

25 32. A method according to claim 31 wherein the restraining polymer has a molecular weight of at least 50,000 daltons and is effective to prevent egress of the restraining polymer from the gel, the restraining polymer having retention groups to bind the active agent to the restraining polymer for retention in the gel beads, being present in a proportion effective to deliver an effective amount of the active agent and being selected from the group consisting of polyquaternium 11, polyquaternium 24, laurdimonium
30 hydroxyethylcellulose, cocodimonium hydroxyethylcellulose, steardimonium hydroxyethylcellulose, quaternary ammonium substituted water-soluble polysaccharides, alkyl quaternary celluloses and polypeptides having or provided with retention groups to retain the active agent.

33. A method according to claim 32 wherein the gel particles are manually crushable on the skin to increase
35 the surface area of the gel particles and expose the restraining polymer to a topical body surface for release of the active agent.

34. A method according to claim 32 wherein the restraining polymer comprises about 0.2 to about 7.5% of the gel particles.

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35. A method according to claim 27 wherein the intermediate temperature is about 45°C.

36. A method according to claim 27 wherein the density-control agent is pre-dispersed in oil.

10 37. A method according to claim 27 comprising admixing an active agent in with the gel bead material ingredients whereby the active agent is incorporated in the gel beads.

38. A method according to claim 27 wherein the density-control agent comprises heat-expandable microspheres.

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39. A method according to claim 27 comprising pre-dispersing a pigment in water and mixing the pre-dispersed pigment with the second mixture before adding the second mixture to the third mixture.

40. A method according to claim 27 wherein the gelling agent comprises about 1.5% of the gel-particles.

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41. A method according to claim 27 wherein the density-control agent comprising about 0.01% to about 5% of the gel particles.

42. A method according to claim 27 wherein the density-control agent comprises about 0.02% to about 0.1% of the gel particles.

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43. A protective cosmetic particulate gel delivery system for a topically applied active agent, the delivery system comprising discrete, self-supporting gel particles of from 0.1mm to 10 mm average size, the particles being insoluble in water at 25° C. and being formed of:

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- a) a liquid medium having a density; and
- b) a plurality of particles dispersed in the liquid medium;

wherein the delivery system comprises:

- c) an effective quantity of a density-reducing agent dispersed within the particles to form density controlled particles wherein the density-reducing agent controls the density of the gel particles.

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44. A density-controlled gel bead suspension suitable for human cosmetic, foodstuff or pharmaceutical use, the suspension comprising:

- a) a transparent liquid medium; and

- 5 b) a plurality of visible gel beads dispersed in the liquid medium, the gel beads optionally being colored;

wherein the gel bead suspension comprises:

- c) a density-reducing agent within the gel beads in a quantity effective to prevent gravitational migration of the gel beads in the liquid medium.

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45. A density-controlled bead suitable for dispersal in a transparent liquid medium to provide a suspension suitable for human cosmetic, foodstuff or pharmaceutical use, the gel bead comprising a structural bead material wherein the density-controlled beads comprise a density-reducing agent within the gel beads in a quantity effective to prevent gravitational migration of the gel beads in the liquid medium.